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ENDANGERED SPECIES TECHNICAL BULLETIN

Department of the Interior • U.S. Fish and Wildlife Service • Endangered Species Program, Washington, D.C. 20240

Special Report

LAST-DITCH CONTINGENCY PLAN SEEN AS ONLY HOPE FOR CALIFORNIA CONDOR

Photo by Fred C. Sibley

This immature California condor was photographed in Ventura County

Following years of speculation on the fate of North America's largest land bird, biologists now generally agree: the California condor is slipping steadily toward extinction. No more than 30 of the huge cathartids are believed to survive in mountainous areas north of Los Angeles, where their future is especially precarious because of increasing land development, diminution of food supplies, lingering pesticides, pollution, and other threats.

This past February, Interior officials made the long-awaited determination. If *Gymnogyps californianus* is to survive, a drastic rescue program must be launched *now,* before time precludes its possible success. Under a "contingency plan" proposed by the Service's California Condor Recovery Team, a full-scale program of increased research, habitat protection, and captive propagation—taking free-living condors and breeding them, with eventual release of their progeny to the wild—will soon be underway in an effort to speed the bird's otherwise grim chances for recovery.

Background

The idea of a contingency plan was first broached in the original California Condor Recovery Plan, approved by the Service in 1975. The recovery plan did not advocate captive breeding, but aimed for maintenance of a wild population of at least 50 individuals, well distributed within their 1974 range, producing at least 4 young per year. Detailed steps to maintain feeding, roosting, and nesting habitat conditions, to minimize annual mortality, and increase public awareness of the bird's problems were set forth at that time. However, the plan noted that this approach may not suffice to save the condor ". . . if numbers have fallen below that 'minimum population density' needed to sustain the species, or if some unidentified limiting factor continues to operate against it." The plan therefore called for continued study of methods to increase reproductive success and, if the situation becomes desperate, to implement a program to artificially increase the bird's productivity.

Developed one year later, the 1976 contingency plan was not conceived as a substitute for implementation of the recovery plan, but as a supplement to it. It called for action on two fronts: (1) the establishment of a captive breeding program, providing for the taking of a number of wild condors

into captivity, and (2) the construction of artificial nest structures in the Tehachapi Mountains to attract breeding condors to the abundant food supplies there.

To some, the idea of human intervention, however competent, spelled even greater risk to the dwindling condor population. But the drafters of the plan recognized the gamble involved. "While there is no guarantee that the project will reverse current trends, the team anticipates that, without it, the condor population will continue to diminish in size and may soon become extinct."

Because of the risks, and in response to what was perceived as a need for impartial review of the situation, the National Audubon Society and American Ornithologists' Union in 1977 appointed a 9-member advisory panel expressly to review the condor problem (including research and available field data), the adequacy of the Service's recovery plan, and the wisdom of implementing the contingency plan in its present form. The result was a comprehensive report, concluding that "the only hope for the species lies in a long-term, large-scale program involving greatly increased research efforts, immediate steps to identify and conserve vast areas of suitable condor habitat, and captive propagation."

(The Advisory Panel specifically recommended research in the areas of population size, movement, and production, and pesticide metabolism and toxicity.)

Fish and Wildlife Service Director Greenwalt also agreed in principle with the contingency plan concept, and appointed a special task force to assess the many recommendations contained in the Advisory Panel Report (as well as those received from other sources) to determine how best to proceed with captive breeding with the least possible risk to the species. The resulting task force report, "Recommendations on Implementing the California Condor Contingency Plan," was approved by the Service on February 23, 1979, constituting a preliminary go-ahead for a comprehensive trapping, marking, and captive propagation program along with a compendium of interdependent activities—all designed to forestall the condor's slip toward extinction.

The Contingency Plan

The decision to opt for such a "radical" course of action was not arrived at hastily or with ease, but cautiously, with broad support from the scientific and ornithological community. As is clear from the details of the plan, its success undoubtedly depends on careful research and management—just as the condor's future appears ultimately bound to conscientious human intervention.

As with any other endeavor of this magnitude, it is easy to understand the importance for both reliable data and the application of sound methods. This is especially true when dealing with an Endangered species whose biology and limiting factors are poorly understood. While many questions remain unanswered, complete and accurate data are vital to the long-term success of the entire recovery and captive breeding effort.

To learn more about condors, their numbers, and their needs, the plan calls for the trapping, marking, and fitting of some free-living condors with radio transmitters. These should provide a wealth of information on nesting sites, reproductive chronology, seasonal movement, daily foraging patterns, disturbance and mortality factors, and social behavior.

There remains some controversy over the number of condors now in existence (as well as over the evidence of decline), because of their wide range and mobility (making exact counting impossible), and due to the use of different methods over the years for estimating population sizes. Direct examination and tracking of individual birds will reveal information on sex ratios and age structure—critical to determining population sizes and trends. (Observation methods will also be standardized.)

Radio tracking will also assist in the identification of breeding birds—critical to the selective capture of nonbreeders in subsequent years—and help distinguish subpopulations, facilitate law enforcement, and generally guide future management actions. (Only through the use of radio-telemetry can these data be obtained in a reasonable period of time.)

Capture, Marking, and Related Research

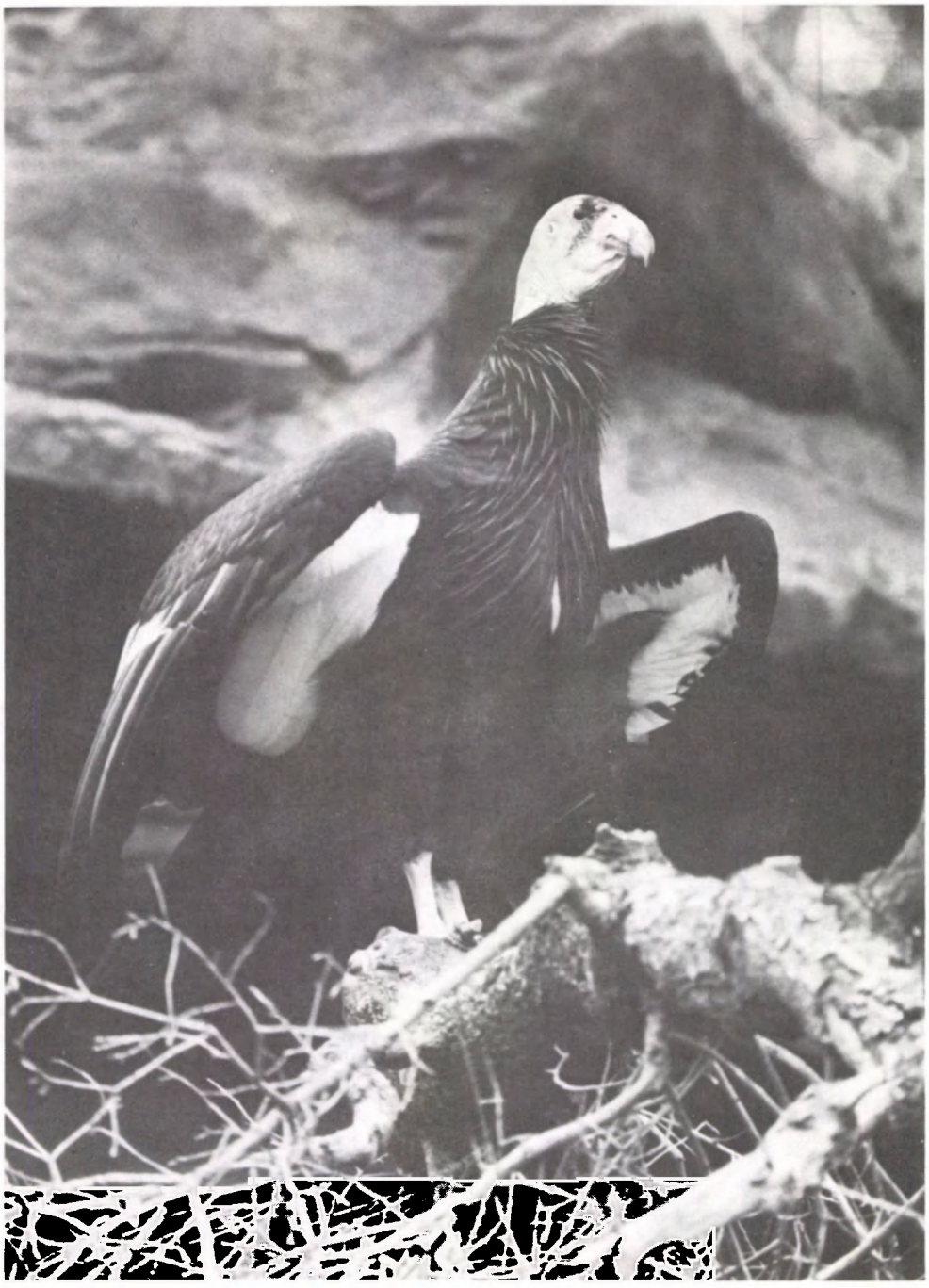
Because of its larger size, its relative vulnerability to human disturbance, and comparatively low reproductive rate, plans now call for trapping within the primary range of the Sespe condor population, to begin January 1980, assuming that all logistic, personnel, and technological preparations are in order. The contingency plan recommends capture during the fall and winter months after hot weather is over, when the birds would be less subject to heat stress. Operations will likely be confined to rangelands of Kern County, where the greatest congregations of condors occur (and where there is less likelihood of capturing adult breeders).

Extraordinary precautions will be taken throughout the capture and handling process to insure the birds' safety. If an individual is thought to be suffering undue stress, its examination will cease and the bird will be allowed to recover before further processing (if it can be done safely), or promptly released. An experienced veterinarian specialist will be present during all capture attempts, with additional veterinarians for multiple captures at separate locations. A fully-equipped mobile operating unit will also be readily accessible. Captured birds will be hooded, restrained, and closely monitored for evidence of color changes and increased respiration or heart beat due to stress.

The first handling priority after capture will be marking the wings (most likely with both patagial discs and monel tags), as well as with tatoos on the ventral apterygium for permanent identification, and then the attachment of tiny radio transmitters. (Application of marking techniques is dependent upon their successful experimentation on Andean condors.)

Unlike Andeans, California condors are not sexually dimorphic. Following the review of available data, two techniques have been recommended by the task force to distinguish males from females upon their capture: fecal steroid analysis, which poses the least risk, and laparoscopy—a technique by which a tiny incision allows penetration of a needle scope to view the gonads to determine the bird's sex. Unfortunately, fecal analysis takes from 36 hours to 3 days to complete (and is only reliable during the breeding season). If time is considered an urgent factor dictating prompt release, then laparoscopy would be the preferred method. (In preparation for capture, experiments will be continued on both of these sex determination techniques in addition to feather pulp analysis, to determine their value (and safety), using turkey vultures and captive Andean condors.)

The Condor Advisory Panel believes that "pesticides are strongly implicated in the recent decline of the population." Few California condors or their eggs have been available for analysis, but one immature bird found dead and dried in 1974 had levels of DDE (a breakdown product of DDT) in its tissues in the range of wild birds of other species whose reproduction was affected by egg-shell thinning. (PCBs, dieldrin, and other chlorinated hydrocarbons were also present.) Another condor shot in 1976, however, contained levels of DDE and other contaminants that were below average for species in the wild. Recent analyses of fecal samples of wild condors have shown no pesticides within the limit of detection.



*The California condor (*Gymnogyps californianus*), a member of the family* Cathartidae *of New World carrion-eating vultures, is the largest land bird in North America. Although never abundant in recent times, condors likely numbered more than 100 prior to 1940. No more than 30 survive today. Weighing 20 pounds, with a wingspread of more than 9 feet, the adult condor is a diurnal scavenger, soaring on thermal currents in search of mammal carcasses on which it feeds. Although the condor's average lifespan may exceed 20 years, captive individuals have lived to more than 40. They assume their adult plumage at about 6 years of age, and begin breeding sometime thereafter. Condors are apparently monogamous. They court in the winter, nesting in a natural cave in sandstone cliffs where they produce a single egg in early spring. The egg is incubated for up to 8 weeks, with the chick remaining in the nest another 20 weeks before fledging in the fall. (The young bird then remains flightless for another 10 weeks, after which it stays with its parents for several months). Because of its extraordinarily long breeding cycle, condors usually skip one breeding season before renesting.*

This is Topatopa, the only living California condor in captivity, at the Los Angeles Zoo. At the age of nine, he has only recently shown signs of interest in breeding.

Photo by Kerby Smith

DDE has also been detected in the membranes of condor eggshell fragments collected over the last decade. (The task force reported evidence of widespread and heavy DDT spraying during 1946-69 in areas overlapping the condor's known range.)

Blood, stool, and feather sampling as well as measurement of general physical characteristics are on the agenda to ascertain levels of pesticides, lead, and other contaminants in captured birds. In addition to these analyses, several studies are to be undertaken in an attempt to pinpoint sources of environmental contamination:

- The condor's natural and supplemental food items will be collected and analyzed. Contaminant levels in species using similar food supplies (golden eagle, turkey vulture, and raven) will also be measured.
- Pharmacokinetic studies on related species will be undertaken to estimate the rate at which a condor's body burden of DDE (and other pesti cides) would be lost if maintained on an uncontaminated diet.
- Studies will be conducted on the relationship between DDE residues, eggshell thinning, and hatching success in vultures.
- Experiments will be conducted on related species to determine the lethal doses of economic poisons (such as Compound 1080), as well as sublethal effects (e.g., on reproduction, hardiness) of various chemicals.

Captive Breeding

As emphasized in the Advisory Panel Report, dividing the condor population betwen wild and captive birds would likely limit the reproductive potential of each. The larger number of birds taken for captive breeding, however, the greater the group's potential productivity. (Therefore, the Service plans are projected to insure viable breeding among both wild and

zona, Texas, Florida, and northern Mexico.

Today, condors occupy a U-shaped portion of California, corresponding roughly with the mountainous terrain surrounding the southern part of the San Joaquin Valley. Remaining individuals are now confined to the Coast Ranges on the west, the Transverse and Tehachapi Mountains at the south, and the Sierra Nevada on the east. Their distribution and seasonal movements (see map) have been relatively unchanged since 1935.

Direct mortality from shooting, as well as specimen and egg collecting over the past century, were certainly primary factors in the early decline of the California condor. More recently, lack of condor production—the probable result of inadvertent poisoning from both insect pest and predator control programs—and occasional man-caused mortality, clearly exaggerated by ever-shrinking and degraded habitat, are major problems for the condor.

Much valuable data on the condor's range and habitat preferences should soon be gathered through radio telemetry. Surveys will be conducted to identify potentially suitable habitat within the condor's former range, to determine food availability, disturbance factors and plans for future development, and land use trends. (Ongoing studies will also chart the details of the condor nesting cycle, determine the feasibility of monitoring nest activity through close-circuit TV, and continue watch over the bird's activities.)

Certain localities are vital to the condor population for its winter survival, and the Service is now seeking the cooperation of private landowners to promote long-term potection of these areas. The Service and other Federal agencies are continuing intensive efforts to protect Critical Habitat for the condor in California, and to keep human activity to a minimum near known nesting areas.

Food is considered a potential limiting factor for the condor (especially in terms of reproduction), and the Service and cooperating agencies will continue to supplement natural food sources near breeding sites as well as in areas where nonbreeders traditionally congregate.

Despite these efforts, and the fact that adequate nest sites are apparently available within the condor's current range, it is believed that a decrease in food near traditional nesting sites may have caused some shift in seasonal condor distribution. Future studies should help to clarify the relationship between nesting and food availability and the cause of shifting distribution patterns. (The placement of several artificial nesting structures may be attempted if research indicates they will help to attract breeding birds to areas having abundant food supplies with minimal human disturbance.)

Administration and Costs

Like all other recovery programs, it is important to note that the "contingency plan" represents a flexible, dynamic concept which will always be subject to review and revision as we learn new information and techniques to promote the condor's survival.

The Service in cooperation with the California Department of Fish and Game) will oversee the recovery program, whatever its form, during all stages of implementation, of this long-term project. A two-tiered administrative approach is now under consideration, to include the designation of both a condor research biologist (to conduct and coordinate all research field work and contracts) and a condor project coordinator to coordinate implementation of the total effort of involved agencies and administer contracts for operations and propagation facilities.

National Audubon Society will fund an additional biologist to assist with biological field work in California, and soon plans to launch a major campaign to raise funds for the captive breeding effort. (Interior and Audubon officials are now working out the details of an agreement to effectuate cooperation between our two organizations during plan implementation.)

As recommended by the Condor Advisory Panel, periodic review of the propagation and research program by the scientific community will be provided for and encouraged. In the meantime, the details of the contingency plan and all pertinent recommendations will be incorporated in a revised recovery plan for the California condor.

With at least preliminary approvals in order, the only remaining obstacle to condor recovery—other than time itself—is money. The Service has managed to reprogram $162,500 from contingency funds to begin research and propagation facilities and to prepare for capture operations this winter. But another $500,000 must be authorized and appropriated by Congress this summer to insure plan implementation in the coming years.

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captive populations.)

Although it is not known with certainty whether two discrete populations of condors exist, Sandy Wilbur (Fish and Wildlife Service biologist and leader of the California Condor Recovery Team) and other biologists have recently concluded that a small subpopulation of condors (estimated at about 8 birds) ranges in the mountains near the California coast, while the larger "Sespe/Sierra" subpopulation (perhaps more than 20 birds) ranges from the Sespe Condor Sanctuary to the Sierra Nevada.

Because of its reproductive success and relative stability, and because its small size and dispersal would make trapping even more difficult, final recommendations do not favor initial capture of birds from the coastal population either for marking or for early use in the captive breeding program. Rather, emphasis will be placed first on capturing a sample of non-adult plumaged birds from the Sespe/Sierra population (most of which apparently are not breeding, and are more subject to habitat disturbance).

Some authorities believe that subadult birds are more amenable to capture, handling, and management, though experience with Andean condors at the Patuxent Center revealed equal success with condors of various ages. However, taking only immature birds, at least initially, would eliminate the risk of removing current breeders from the wild or preventing the return of parent birds to eggs or nestlings.

While attempting to capture only immature birds this coming winter, priority will subsequently be placed on the capture of an unpaired female as a mate for "Topatopa," the only California condor now in captivity. After several years of experience and feedback on population data, emphasis will be directed toward the taking of adult plumage birds to complete the recommended quota of five pairs (inclusive of Topatopa) needed for the initial propagation program objective. This might mean the eventual removal of 9 birds from the wild Sespe population. (Additional birds may later be taken from the Sespe *and* coastal populations to augment the captive flock (and to insure genetic diversity) contingent upon the compatibility of the initial five pairs, ongoing pesticide analyses, and the apparent success of the breeding program.)

Although the geographic location of captive breeding facilities is not considered critical to the success of the breeding program, a majority of opinions (including California State representatives) favor rearing of the birds in California. A California facility would likely impose less physiological strain on captured birds and would minimize long-term logistical problems. The consensus is that multiple facilities are far preferable to a single breeding location for several reasons: they afford greater safety to the birds in case of a catastrophe at one location; they offer protection against jeopardy from local pollution and contagious disease; and they encourage comparative analysis and observation.

A pair of California condors in the National Zoological Park (1937 photo).

Planners currently recommend placement of the first 4 immature condors captured for propagation in holding facilities at the San Diego Zoo. (Upon their subsequent capture, two additional pairs would be placed at a second location.)

With its modern facilities and backup capability, as well as its expert ornithological and veterinary staff, the San Diego Zoo has been recommended as the primary breeding location. Moreover, the zoo has a long-term management plan for bird breeding, and has an isolated semi-wild location free of human disturbance which is suitable for maintaining two pairs of condors.

There is a good record of breeding success with cathartids in captivity. Andean condors have proven extremely hardy, with several known to live for more than 50 years in captivity. These close relatives of the California condor have been reared at a dozen zoos as well as the Service's Patuxent Wildlife Research Center.

Patuxent started its breeding programs for Andeans in 1965, with 9 immature birds. After some trading to balance sex ratios, Patuxent had four compatible pairs, with the first eggs produced in 1971. The first chick was reared in 1973, and another seven healthy chicks have been raised since that time. This year all four pairs produced a first and second clutch, for a total of 8 eggs (4 of which are now in Patuxent's incubators, the remaining being naturally incubated).

The Bronx Zoo has also experienced extraordinary success with Andean condors. "Mrs. McNasty," a resident of the zoo for about 10 years, has produced seven fertile eggs in the last 3 years. Three young were produced from three eggs induced in 1977; two more young were reared in 1978; and two fertile eggs have already been produced this year.

William G. Conway, General Director of the New York Zoological Society, which runs the Bronx Zoo and Aquarium, believes "we're beginning to understand how to handle these birds and how to breed them in captivity—even in facilities such as ours, constructed in 1911, that are less than ideal." Immature birds produced by the captive Bronx pair have been placed together in a flock so that their socialization process can be observed, where Conway says imprinting on humans has not been a factor affecting social development. Conway thinks that the information on Andeans may with some confidence be applied to California condors—a feeling shared by many experienced biologists like Ray Erickson, head of the Service's Endangered Wildlife Research Program at the Patuxent Center. "Prop-

erly managed, there is no reason why California condors shouldn't breed with maximum success," Erickson believes. "Condors are long-lived, they appear to stay healthy, and they can be induced to increase their egg production in captivity. And considering their long-term downward trend, we have no other alternative left to prevent their extinction."

Experience with captive California condors also indicates that the prospects are good. During the 1920's, a female at the National Zoological Park in Washington laid 13 eggs in 11 years, showing evidence of recycling. California condors do well in captivity, with three known to live to 36, 40, and 46 years. Information on housing and diet, induction of double-clutching, annual breeding, artificial incubation, and hand-rearing is available based on the Service's work with Andeans. The task force therefore recommends that captive propagation and management of California condors follow the general guidelines formulated by Patuxent.

(Because of its proven success in some species, "double-clutching"—the technique of removing eggs to induce the laying of a second clutch—has been considered for ultimate application with wild condors. However, much more data on the birds' breeding activities will be needed before looking into the feasibility of this practice with California condors.)

Release

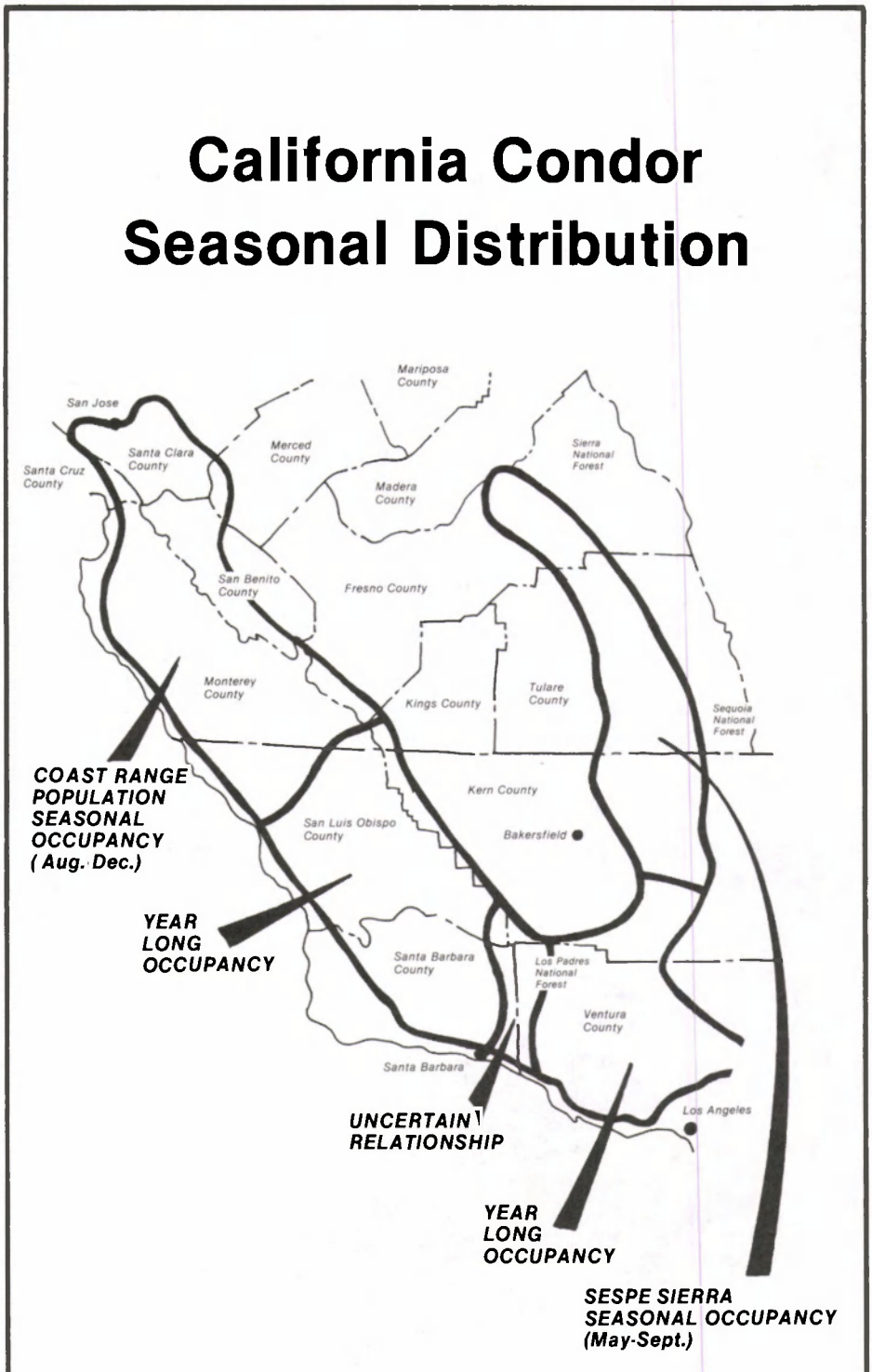
Experiments with black and turkey vultures have provided a model on which to base release procedures for the larger cathartids. In preparation for the eventual release of the progeny of California condors, the Service plans to contract with Stanley Temple (University of Wisconsin-Madison) to refine tested techniques through the release of captive-produced Andean condors in South America.

Results of ongoing experiments with turkey and black vultures indicate that the release of fledging-age birds, reared through most of their nestling life as a group (with minimal human contact), is the most effective method and allows the smoothest integration into a wild population. Young Andean condors (and fledglings) from Patuxent and the Bronx Zoo will most likely be released over the next year in small groups on an isolated peninsula in northern Peru with apparently ideal conditions for their survival. (Patagial markers and radio transmitters will also be placed on the birds, enabling tracking and follow-up observations in subsquent years.)

Planning for the release of young California condors would then be based on habitat surveys (to determine optimum sites) and on the success of experiments with the young Andeans.

Habitat Evaluation and Protection

Since 1800, California condors are known to have ranged from Baja California to British Columbia, although they have apparently bred only in California and northern Baja California during the past 100 years. Fossil records reveal the presence of *Gymnogyps* vultures (either the current species or a similar one) from California, Oregon, Nevada, New Mexico, Ari-



This wishbone-shaped area is believed to contain all remaining California condors. Current knowledge indicates that the Sespe/Sierra population nests year-long near Ojai, ranging north to the Sierra National Forest during May-September. The coast range population winters in Santa Barbara and San Luis Obispo Counties, ranging northward to Santa Clara County during August-December.